Additional Chapter 13 Problems

MA2160, Spring '07

For the following problem, let $u = \overrightarrow{PQ}$ and $v = \overrightarrow{PR}$, and find

(a). the component forms of u and v

(b). the magnitude of v

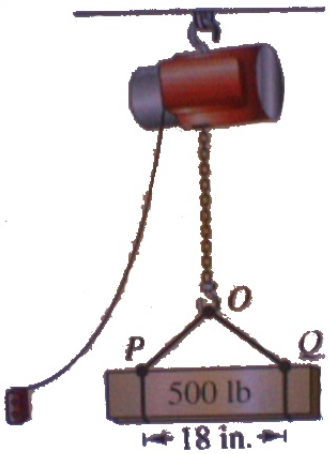
(c). $2u + v$

1. $P = (1, 2), Q = (4, 1), R = (5, 4)$

For the following problem, find the component form of the vector v given its magnitude and the angle it makes with the x-axis.

2. $\|v\| = \frac{1}{2}, \theta = 225°$

3. ***Minimum Length*** In a manufacturing process, an electric hose lifts 500-pound ingots. The length of the cable (see figure below). The length of the cable connecting points P, O, and Q is L inches. (Assume that O is at the midpoint of the cable.)



   (a). Write the tension T in the cable as a function of L. What is the domain of the function?

   (b). Use the function in part (a) to complete the table.

L	19	20	21	22	23	24	25
T							

   (c). Use a graphing utility to graph the tension function.

   (d). Find the shortest cable connecting points P, O, and Q that can be used if the tension in the cable cannot exceed 400 pounds.

   (e). Find (if possible) $\lim_{L \to \infty} T$. Interpret the result in the context of the problem.

4. Find the coordinates of the point located on the y-axis and 7 units to the left of the xz-plane.

For the following problem, determine the location of the point (x, y, z) such that the given condition is satisfied

5. $xy < 0$

The initial point and terminal point of a vector are given. Sketch the directed line segment and find its component form of the vector.

6. Initial Point: $(6, 2, 0)$ and Terminal Point: $(3, -3, 8)$

For the following problem, use vectors to determine whether the points lie on a straight line.

7. $(5, -4, 7), (8, -5, 5), (11, 6, 3)$

8. Find a vector v of magnitude 8 in the direction $6\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$.

Let $u = \overrightarrow{PQ}$ and $v = \overrightarrow{PR}$ and find

(a). the component forms of u and v

(b). $u \cdot v$

(c). $v \cdot v$

9. $P = (2, -1, 3), Q = (0, 5, 1), R = (5, 5, 0)$

Determine whether the vectors are orthogonal, parallel, or neither.

10. $-4\hat{\imath} + 3\hat{\jmath} - 6\hat{k}, 16\hat{\imath} - 12\hat{\jmath} + 24\hat{k}$

For the following, find the angle θ between the vectors u and v.

11. $u = 4\hat{\imath} - 1\hat{\jmath} + 5\hat{k}$, $v = 3\hat{\imath} + 2\hat{\jmath} - 2\hat{k}$
12. $u = \hat{\imath} - 3\hat{k}$, $v = 2\hat{\imath} - 2\hat{\jmath} + \hat{k}$

13. ***Work*** An object is pulled 8 feet across a floor using a force of 75 pounds. Find the work done if the direction of the force is 30° above the horizontal.

For the following, let $u = 3\hat{\imath} - 2\hat{\jmath} + \hat{k}$, $v = 2\hat{\imath} - 4\hat{\jmath} - 3\hat{k}$, and $w = -\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$.

14. Find the angle between u and v.
15. Find the work done in moving an object along the vector u if the applied force is w.

For the following problem

(a). find the projection of u onto v

(b). find the vector component orthogonal to v

16. $u = \hat{\imath} + 4\hat{k}$, $v = 3\hat{\imath} + 2\hat{k}$

For the following problems let $u = 3\hat{\imath} - 2\hat{\jmath} + \hat{k}$, $v = 2\hat{\imath} - 4\hat{\jmath} - 3\hat{k}$, and $w = -\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$.

17. Show that $u \times v = -(v \times u)$.
18. Show that $u \times (v + w) = (u \times v) + (u \times w)$.
19. Find the area of the triangle with adjacent sides v and w.

20. ***Volume*** Use the triple scalar product to find the volume of the parallelepiped with edges $u = 2\hat{\imath} + \hat{\jmath}$, $v = 2\hat{\jmath} + \hat{k}$ and $w = -\hat{\jmath} + 2\hat{k}$